REMARKS

In view of the following remarks, reconsideration of the rejections contained in the Office Action of April 23, 2003 is respectfully requested.

Claims 13-23, including independent claims 13 and 19, are presently pending in this application. In the outstanding Office Action, the Examiner has rejected independent claim 13 as being anticipated by the Shinjo reference (USP 5,538,695); as being anticipated by the Kamiya reference (USP 5,549,874); as being anticipated by the Duarte reference (USP 5,554,344); and as being anticipated by JP'627 (JP 2540627). In addition, the Examiner has rejected independent claim 19 as being unpatentable over the Shinjo reference; and as being unpatentable over the Kamiya reference. Furthermore, the Examiner has rejected dependent claims 16 and 22 as being unpatentable over the Shinjo reference and the JP '627 reference, and further in view of the Ishioka reference (USP 6,027,700).

In view of these rejections, an interview was conducted with the Examiner on July 22, 2003 ("the interview"). During the interview, the arrangement of the present invention (as well as the associated benefits achieved from the particular arrangement of the present invention) were discussed. In addition, the distinctions between the present invention as recited in the claims (particularly, independent claims 13 and 19) and the applied prior art were also discussed. Thus, as explained to the Examiner during the interview, the Examiner's prior art rejections of pending claims 13-23 are respectfully traversed, and it is submitted that claims 13-23 are clearly patentable over the prior art of record for the reasons set forth below.

The present invention is directed to an improved apparatus for ozone generation. Although the need for ozone as a cleaning agent has rapidly increased in recent years, prior art ozone generators are generally inefficient and the concentration of ozone produced by these prior art generators is too low. As a result, the ability to use ozone as a cleaning agent is negatively impacted (see page 3, line 32 through page 4, line 4 of the original specification).

When material gas flows through a prior art ozone generator such as that shown in Figure 12, the material gas flows along the grooves formed in the high voltage electrode 13 formed by the indentation 11 and ridge portions 12. In other words, the gas flows in a direction

perpendicular to the surface of the paper on which Figure 12 is printed. Although a high density of discharge is located near the ridge portion 12 of the high voltage electrode 13, the material gas (particularly during reduced flow rates) tends to collect in the region Q located closest to the indentation 11. The tendency of the gas to collect and flow only in these areas causes inefficient ozone generation. Thus, in order to improve ozone generation, the present inventors have determined that an ozone generator must be designed so that the material gas is forced to flow over the ridge portions 12 of the high voltage electrode 13, where a high density of discharge is located.

In particular, the inventors have developed an ozone generator that comprises, as recited in independent claim 13, a pair of electrodes spaced apart so as to form a gas flow space therebetween. At least one of the electrodes has a plurality of *parallel* grooves formed on a surface thereof facing the gas flow space. A gas flow passage includes an inlet port for supplying a material gas into the gas flow space, and includes an outlet port for discharging the material gas from the gas flow space. The gas flow passage (including the outlet port and the inlet port) is arranged so that the material gas *flows through the gas flow space in a direction transverse to a longitudinal direction of the parallel grooves.*

By providing *parallel* grooves (as opposed to spiral grooves) on the surface of an electrode, and then arranging the gas flow passage including the inlet port and the outlet port so that the material gas *must flow* in a direction transverse to the longitudinal direction of the parallel grooves, the material gas is forced to flow over the ridge portions of the grooves. The inventors of the present invention have recognized that designing an ozone generator in this manner will force the material gas to flow where a high discharge density is produced, thereby increasing ozone generation (see page 11, lines 11-16 of the original specification).

The Applicants acknowledge that functional language is recited in independent clam 13 to describe the structural relationship between elements of the claimed invention (and, particularly, the arrangement of the gas flow passage with respect to the parallel grooves). Unfortunately, based on the Examiner's comments set forth in the outstanding Office Action and made during the interview, it appears that the Examiner is improperly either disregarding the functional language

or affording the functional language very little weight. As explained to the Examiner during the interview, however, functional language recited in an apparatus claim to describe the structure of the claimed apparatus is entitled to as much patentable weight as any other positively-recited limitation in the claims. See *K-2 Corp. vs. Salomon S. A.* 191 F.3d 1356, 1363, 52 USPQ2d 1001, 1006 (Fed. Circ. 1999) ("The functional language is, of course, an additional limitation in the claim."); *Wright Med. Tech., Inc. v. Osteonics Corp.*, 122 F.3d 1440, 1443-44, 43 USPQ2d 1837, 1840 (Fed. Circ. 1997) (functional language analyzed as a claim limitation). Therefore, the functional language recited in the present claims, such as the limitation "said gas flow passage being arranged so that the material gas flows through said gas flow space in a direction transverse to a longitudinal direction of said parallel grooves" is entitled to full patentable weight by the Examiner.

Even if the functional language recited in the claims of the present invention *is* afforded a proper amount of patentable weight, it appears that the Examiner is dismissing this limitation as being "general knowledge" without providing any evidence to support this position. In particular, the Examiner asserted during the interview that arranging a gas flow passage as recited in independent claim 13 would be obvious, even though the Examiner has not cited any references that disclose or even suggest this arrangement. In this regard, the Federal Circuit has held that an obviousness determination relying on "general knowledge" requires that this general knowledge be articulated in the record as reasoned findings (e.g., evidence in the form of prior art references). See *In re Sang Su Lee*, 277 F.3d 1338; 61 USPQ2d 1430 (Fed. Circ. 2002); *In re Dembiczak,* 175 F.3d 1994, 1999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) ("our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to [modify or] combine prior art references."). Therefore, to the extend that the Examiner is relying on hindsight and mere conclusions that the arrangement of the gas flow passage of the present invention is obvious, it is submitted that these rejections are improper for the reasons expressed above.

The Duarte reference discloses a gas ionization device including an inner electrode tube 5, a dielectric tube 3, and an outer electrode tube 4. As illustrated in Figure 2, the outer surface of the inner electrode tube 5 and the inner surface of the outer electrode tube 4 have a spiked pattern etched thereon. However, as explained in column 4, lines 6-19, the electrodes are etched with a ***spiral*** spiked pattern. Thus, the Duarte reference does not disclose or suggest at least one electrode having a plurality of *parallel* grooves formed on a surface thereof, as recited in claim 13. Moreover, column 4, lines 18-22 of the Duarte reference explain that the spiral spikes direct the feed gas in such a manner so as to cover the entire electrode surface. In other words, the Duarte reference is designed so that the gas will follow along the indentation in the *spiral* spikes so as to cover the electrode surface, in direct contrast to flowing in a direction *transverse* to a longitudinal direction of *parallel* grooves as in the present invention. Therefore, it is respectfully submitted that the Duarte reference does not disclose or even suggest the invention recited in independent claim 13.

The Shinjo reference and the Kamiya reference disclose ozone generators in which grooves are formed in at least one of the electrodes of the ozone generator. However, these references do not disclose or even suggest a gas flow passage that is arranged so that the material gas flows through the gas flow space between the electrodes in a direction *transverse* to a longitudinal direction of the parallel grooves. In this regard, the Examiner has acknowledged that the Shinjo reference is silent with respect to an inlet port, and the Examiner does not discuss the presence of an inlet port or an outlet port in the Kamiya reference. Nonetheless, in the Office Action, and again during the interview of July 22, 2003, the Examiner has taken the position that an inlet port and an outlet port are inherent (or at least obvious) for supplying gas into the gas flow space. Thus, the Examiner has apparently either improperly disregarded the limitation (recited using functional language) that describes the gas flow passage as being arranged such that the material gas flows *in a direction transverse to a longitudinal direction of the parallel grooves,* or the Examiner has improperly used mere hindsight to assert that this limitation in obvious. As explained above, it is well-established that an Applicant can use functional language to describe structural elements in an apparatus claim, and this functional language is entitled to

full patentable weight. Furthermore, the Examiner must provide support for a position that a limitation constitutes mere "general knowledge."

The JP'627 reference discloses an ozone generating device including an electrode 2 having projections 4. However, as explained in paragraph 22 on page 12 of the English translation, "the source gas is set to flow in the direction *parallel* to the longitudinal direction of the projections of the first electrode 2" (emphasis added). Moreover, this reference actually *teaches away* from the arrangement of the gas flow passage as recited in claim 13 by explaining that if the direction of the air current is orthogonal (i.e., transverse) to the longitudinal direction of the projections 4, an undesirable pressure loss will result. Therefore, this reference explains that "the air current *needs to be set parallel to the longitudinal direction of the projecting parts 4*." (see paragraph 18, page 10 of the English translation). Thus, the JP'627 reference also does not suggest, and in fact teaches away from, the arrangement recited in independent claim 13.

The Ishioka reference also does not disclose or suggest an ozone generator including a gas flow passage arranged as recited in claim 13. Therefore, one of ordinary skill in the art would not be motivated to modify or combine the Shinjo reference, the Kamiya reference, the Duarte reference, the JP'627 reference, and the Ishioka reference so as to obtain the invention recited in independent claim 13. Accordingly, it is respectfully submitted that independent claim 13 and the claims that depend therefrom are clearly patentable over the prior art of record.

New independent claim 19 is directed to an electric discharge cell for an ozone generator, including a pair of electrodes spaced apart in an opposing relationship so as to form a gas flow space therebetween. A first one of the electrodes has a plurality of *concentric circular grooves* formed on a disc-shaped surface thereof facing the gas flow space. A gas flow passage includes an inlet port for supplying a material gas into the gas flow space, and includes an outlet port for discharging the material gas from the gas flow space. The gas flow space is arranged so that the material gas flows through the gas flow space *in a radial direction transverse to the concentric circular grooves*.

During the interview, the Applicants' representative attempted to explain the invention recited in independent claim 19 to the Examiner with respect to Figures 1 and 2 of the present

application. However, the Examiner acknowledged having some difficulty understanding the arrangement of the present invention illustrated in these figures. Therefore, for the Examiner's benefit, the Applicants have prepared and attached hereto an Appendix to assist in the Examiner's understanding of the invention recited in independent claim 19. As the Examiner will see, the Figures included in the Appendix correspond to Figures 1 and 2 of the present application, but the unnecessary reference numbers have been removed, and lines with arrows indicating the possible flow paths of the material gas through the electric discharge cell have been added. It is to be noted, however, that these drawings are provided only to aid the Examiner's understanding of the present invention, and are not intended to otherwise limit the scope of the claims to the specific embodiment shown in these drawings.

As can be seen in Figures 1 and 2 of the attached Appendix, the air enters the electric discharge cell at either a central location or a peripheral location of a pair of electrodes, and flows in a radial direction *transverse to concentric circular grooves* formed on surface of one of the electrodes. As explained above, lines have been added to Figures 1 and 2 in order to show the possible flow paths of the material gas through the gas flow passage of the electric discharge cell. Since the inlet port can comprise either port 25 or port 28, arrows have been provided showing that the material gas can flow in both directions. Due to this arrangement as shown in Figures 1 and 2 (and recited in independent claim 19), the material gas is forced to pass over ridge portions of the concentric circular grooves, where high discharge density is obtained. Consequently, it is possible to generate a high concentration of ozone with the arrangement recited in claim 19.

As explained above with respect to new independent claim 13, the Shinjo reference, the Kamiya reference, the Duarte reference, the JP'627 reference, and the Ishioka reference do not, either alone or in combination, disclose or suggest a gas flow passage arranged so that the material gas must flow through the gas flow passage in a direction *transverse* to parallel (or concentric) grooves formed in an electrode as recited in independent claim 19. Therefore, one of ordinary skill in the art would not be motivated to modify or combine the references so as to obtain the invention recited in independent claim 19. Accordingly, it is respectfully submitted that

independent claim 19 and the claims that depend therefrom are clearly patentable over the prior art of record.

In view of the above remarks, it is submitted that the present application is now in condition for allowance. However, if the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact the Applicant's undersigned representative.

Respectfully submitted,

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July 23, 2003